REPORT ON THE THIRD INTERNATIONAL SYMPOSIUM OF TROPICAL ROOT CROPS HELD AT THE INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE, IBADAN, NIGERIA, DECEMBER 2-9, 1973

H. David Thurston

This symposium was sponsored by the International Society for Tropical Root Crops. The Society had its first meeting in 1967 in Trinidad, helped by support from the Rockefeller Foundation, and its second meeting in Hawaii in 1970. The Ibadan symposium was hosted by the International Institute of Tropical Agriculture (I.I.T.A.). With the support of the International Development Research Center (I.D.R.C.), Canada, the Society was able to offer 18 travel fellowships to young scientists from developing countries of Africa, Asia, and Latin America, including the Caribbean. Although no list of participants was made available, approximately 120 people attended. There was good attendance from various African countries, a few delegates from S.E. Asia (Malaysia, The Philippines, some Pacific Islands), and Latin America and the Caribbean were well represented; (7 delegates from Colombia - C.I.A.T., and from Venezuela, Cuba, Nicaragua, and Trinidad. Only two delegates arrived from Brazil, which grows one-third of the world's cassava and is the largest producer in the world.

The society includes cassava, sweet potatoes, yams (Dioscorea sp.), Aracaccia, Aroid crop plants, potatoes, and minor root crops of tropical origins in its definition of tropical root crops.

Until the last five years tropical root crops (with the exception of potatoes and sweet potatoes) have been largely ignored by research workers in tropical countries. After rice, cassava, sweet potatoes and yams are major food crops of the tropics. Cassava provides a major source of calories to over 300 million people. Indonesia, the second largest cassava producer in the world (10.8 million tons/year), had no representatives at the conference. The tropical root crops hardly enter into world commerce when compared to the cereals. One major reason is that they are difficult to store fresh, but they are probably far more important as food in the tropics than available figures indicate. Over 70 million dollars worth of cassava is imported into Europe from the tropics to feed animals every year. Yields of cassava in Brazil, expressed as calories per hectare, are about three times those from corn or rice. With only a minimum of research, the starchy root and tuber crops have a real potential for rapidly reducing food shortages in tropical countries.

Program

A copy of the symposium program (schedule of papers) is included with this report. Less than half of the papers listed were presented, as many participants were unable to obtain funds to attend the meeting. Mimeographed,

complete versions of the papers presented were distributed. All papers relating to plant protection are on file and will be distributed to anyone requesting them. Papers presented at Ibadan will be published in the proceedings of the symposium, but this may take a year or more.

Organization of the Symposium - The symposium was organized into the following Sessions:

1. Genetics, Breeding, Improvement, and Classification
2. Physiology and Biochemistry
3. Agronomy, Mechanization, and Production Systems
4. Crop Protection - Weeds, Pests and Diseases
5. Storage, Processing, Utilization and Food Value
6. Economics and Sociology of Root Crop Production

Cassava - The major emphasis of the symposium was on cassava. The research on cassava in the last 4-5 years has increased manyfold, primarily due to the programs of C.I.A.T. (Centro Nacional de Agricultura Tropical, Cali, Colombia), and I.I.T.A. Both international centers have very extensive cassava breeding programs and appear to be making excellent progress in breeding for yield, resistance to pests, and other agronomic characters. The most serious cassava problem in Africa is African cassava mosaic, which infects almost all cassava in tropical Africa causing serious losses in yield. The causal agent is still unknown, although a virus is suspected. Considerable controversy on the magnitude of yield losses emphasized the need for reliable information in this area. Crosses made in Africa before World War II between Manihot esculenta (cassava) and Manihot glaziovii (Ceara rubber) gave resistance to cassava mosaic, but many were lost after the independence of many African countries. This same cross is again giving what appears to be excellent resistance to African cassava mosaic at I.I.T.A. Perhaps the second most important cassava pest is bacterial blight of cassava. It is serious in Central and South America and parts of Africa. Excellent studies made at C.I.A.T. have shown how to control the disease by the use of resistant varieties and the production of certified-bacterial free planting material, obtained from plants propagated from shoot-tip cuttings. Weed control in cassava was shown to be of importance, especially during the first 60 days of growth. Little information was presented on insect pests of cassava and the concept of integrated control of cassava pests was not mentioned during the conference. The general impression given during the symposium was that only a handful of people in the entire world are working on pest control in cassava although serious losses due to pests are being suffered in all cassava growing areas.

Unless cassava roots are dried, they deteriorate 2-3 days after harvest. A study in C.I.A.T. showed that if cassava roots are cured and held in earthen "clamps" they can be stored for eight weeks. This study on root storage and others on more economical and efficient methods for drying and storing cassava could have a great impact on cassava utilization.

Other Root and Tuber Crops

It would be difficult to discuss in any detail the many papers given on other tropical root and tuber crops.

Yams perhaps received more attention than any other crop except cassava. Although there are over 600 species of yams (Dioscorea sp.), only a few species are important as food. Transfer of information about one species to another is often difficult. Yams can be successfully stored in the tropics up to 6 months, but several pests cause serious storage losses. Nigeria alone produces over 11 million tons of yams per year. I.I.T.A. has a large yam breeding program and is beginning work on control of yam pests. Information on pest control in yams seems to be more poorly developed than that on cassava.

Sweet potatoes have an unrealized potential in tropical and sub-tropical areas. Considerable research has been made on sweet potatoes in sub-tropical regions of developed countries and much of this is valuable in tropical regions. I.I.T.A. has started a sweet potato program on a modest scale. Serious pest problems, especially insects such as the sweet potato weevil, and diseases are receiving attention. As is the case with cassava and yams, sociological problems of acceptance seem to be a serious barrier to the greater use of sweet potatoes in many societies.

Other root crops such as the edible aroids, potatoes (very few papers were presented on potatoes and it is doubtful whether they are appropriate in a conference of this type considering the enormous amount of work given on potatoes at other meetings such as those of the American Potato Association and the European Potato Association), the yam bean, and other tropical root crops were also presented. The great diversity of these crops makes scheduling sessions most difficult as, for instance, the full time cassava workers may have difficulty becoming interested in problems of taro or tannia. As the symposia attendance grows, simultaneous sessions and a breakdown into interest groups will become necessary. Compared to conferences on the major cereals, the Society for Tropical Root Crops is in its infancy. Nevertheless, a solid core of knowledgeable researchers is developing and important interchange of information and materials is beginning. Numerous opportunities exist for real contributions to pest protection of tropical root crops which could have a significant affect on food production in the developing countries of the tropics.

Individual Contacts with Symposium Delegates

I had the opportunity to make individual contacts with a number of symposium delegates, to discuss the objectives of the UC/AID pest management project with them, and in the case of I.I.T.A. and C.I.A.T. staff members, to discuss in some depth their programs and research. The following are some of the individual contacts which are most pertinent:

1. Dr. D. G. Coursey, Dr. P. H. Haynes, and Dr. L. A. Wilson: - Dr. Coursey spent many years in Nigeria working with tropical root crops. He has written the best book available on yams and is a recognized world authority on tropical root and tuber crops. He is with the Tropical Products Institute, London, England and is an officer of the International Society for Tropical Root Crops. I also met with Dr. P. H. Haynes, (F.A.O. Agronomist, Koronivia Research Station, Fiji Islands) and Dr. L. A. Wilson, (Department of Biological Sciences, University of the West Indies, Trinidad), who are also officers of the

Society and recognized experts on tropical root crops. The Society is anxious to increase knowledge among tropical scientists on tropical root crops by dissemination of information, materials, and personnel, and to encourage the efficient production and utilization of these crops.

2. Dr. J. D. Doll: - Dr. Doll is the weed scientist at C.I.A.T., Colombia, worked with the Oregon Weed Project, and is well aquainted with the UC/AID pest management project. The work he reported on at the meeting and his program at C.I.A.T. seems to be of the high quality, and he would be an excellent source of information on weed control and a possible future cooperator for our project.

3. Dr. T. P. Hernandez: - Dr. Hernandez is the sweet potato breeder at Louisiana State University and has a broad program with sweet potatoes which includes breeding for insect resistance. He should be an excellent resource of information and advice on sweet potatoes.

4. Dr. D. L. Jennings: - Dr. Jennings is with the Scottish Horticultural Research Institute, Scotland, but spent many years in East Africa breeding cassava for resistance to African cassava mosaic and is most knowledgeable in this area. He presented a paper (with A. F. Murant and I. M. Roberts) showing that the report of virus particles in material affected by African cassava mosaic by Plasvic-Banjac and Maramorosch was in error, as similar particles were found in light and electron microscope examination of healthy plants. The filamentous particles resemble those reported in other latex containing plants are probably a normal host component. Thus the causal agent of African cassava mosaic is still unknown.

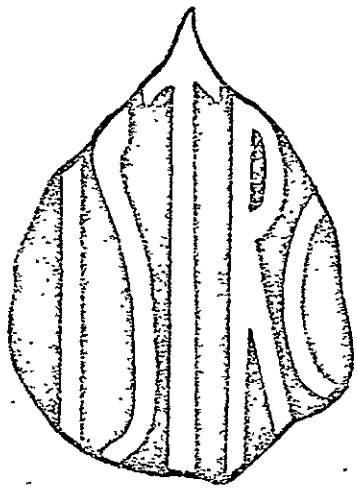
5. Dr. Carlos Lozano, Dr. R. H. Booth, and Dr. James Cock: - Dr. Lozano is the cassava plant pathologist at C.I.A.T. He has done an excellent job in identifying (with Dr. R. H. Booth of the Tropical Products Institute, London), the major cassava diseases and especially in devising controls for cassava bacterial blight which once threatened to eliminate C.I.A.T.'s entire cassava collection. He and Dr. Booth recently reported a serious disease of cassava from Colombia called superelongation. For years the disease was thought to be caused by a virus, but they showed the disease to be caused by a fungus tentatively identified as a Taphrina sp. Dr. Booth has done some outstanding work on storage of cassava (already described in the report) and both he and Dr. Lozano should be excellent resources for information and advice on cassava diseases. Dr. James Cock is the leader of the cassava program in C.I.A.T., is an English Plant Physiologist with experience in I.R.R.I., The Philippines, and is a dynamic and knowledgeable leader of the cassava programs. C.I.A.T. has no cassava entomologist at present.

6. Dr. S. K. Hahn, Dr. Sidi Sadik, and Dr. E. R. Terry: - Dr. Hahn is a Korean plant breeder and has a very large breeding program with cassava, sweet potatoes, and yams. He is the leader of the root and tuber improvement program of I.I.T.A. Dr. Sidi Sadik is an Israeli and a plant physiologist. Dr. E. R. Terry is from Sierra Leone and recently received the Ph.D. in plant pathology from the University of

Illinois. Both Dr. Hahn and Dr. Terry expressed interest in obtaining cooperation from other institutions, especially in the identification and characterization of the unknown causal agent of African Cassava mosaic. The crosses of M. esculenta with M. glaziovii of the breeding program at I.I.T.A. give promise that African cassava mosaic may be controlled through resistant varieties. I.I.T.A. is looking for a qualified entomologist for their cassava program.

7. Dr. R. J. Williams: - Dr. Williams is an English plant pathologist. Until the arrival of Dr. Terry he worked on both cassava and grain legume problems, but now is full time on grain legume pathology. The principal legumes are cowpeas and soybeans. He has developed cowpea lines with multiple disease resistance to anthracnose, Cercospora leaf spot, and other pathogens. His excellent program should have wide applicability in tropical areas to pathological problems on grain legumes.

H. David Thurston



Third International Symposium on Tropical Root Crops

AT

The International Institute of Tropical Agriculture

IBADAN—NIGERIA

DECEMBER 2—9, 1973

SCHEDULE OF PAPERS

INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS

F O R E W O R D

The Organizing Committee for the Third International Symposium on Tropical Root Crops has made available to delegates a Schedule of all papers submitted to the Committee, irrespective of whether papers will be presented at the Symposium or not.

The purpose of presenting this complete schedule is to inform Delegates and Society Members of on-going investigations in Research and Development of Tropical Root Crops in Universities, Research Institutes and Stations, Ministries of Agriculture as well as in Private Companies throughout the world.

It is hoped that by so doing, researchers in similar areas of Root Crop Research will correspond with one another in order to prevent unnecessary duplication of research effort in a field of research in which so much remains to be done with such limited resources.

The order of presentation of papers at the Symposium will be announced by Session Chairmen, within the framework of listed sub-topics in each Session.

Lawrence A. Wilson

LAWRENCE A. WILSON
Chairman, Organizing Committee

GENETICS, BREEDING, IMPROVEMENT AND CLASSIFICATION

SESSION 1

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GENETICS, BREEDING, IMPROVEMENT AND CLASSIFICATION

STUDY GROUP REPORT

GBIC/1 JENNINGS, D.L. and MARTIN, F.W. Scottish Horticultural Research Institute, Dundee, Scotland. *The utilization of cassava variability on an International basis.*

GERMPLASM

GBIC/2 ABRAHAM, A., NINAN, C.A., ABRAHAM, S., CHANDRASEKHARAN NAIR, P.N., MADHAVADIAN, P. and GOPLAKRISHNA, P. Kerala University, India. *Conservation and evaluation of tuber crop germplasm in Kerala.*

MANIHOT ESCULENTA (Cassava)

GBIC/3 HAHN, S.K. , HOWLAND, A.K., SINGH, S.R. International Institute of Tropical Agriculture, Ibadan, Nigeria. *Cassava breeding at IITA.*

GBIC/4 HRISHI, N. and JOS, J.S. Central Tuber Crops Research Institute, Trivandrum, India. *Breeding for protein enhancement in cassava.*

GBIC/5 MAGOON, M.L. and KRISHNAN, R. Indian Grassland and Fodder Research Institute, Jhansi, India. *Extending frontiers of genetic improvement in cassava.*

GBIC/6 NORMANHA, E.S.; PEREIRA, A.S, RIBEIRO DA SILVA, J. Institute of Agronomy, Sao Paulo, Brazil. *Records of cassava hybridization - Flower pollination to Fruit Dehiscence.*

GBIC/7 FORNO, A.A., ASHER, C.J., EDWARDS, D.G. and EVENSON, J.P. University of Queensland, Brisbane, Australia. *Physiological variability in the mineral nutrition of cassava (M. esculenta Crantz).*

GBIC/8 ENE, L.S.O. Federal Agricultural Research and Training Station, Umudike, Africa. *Cytological studies in some local collections of the Genus Manihot.*

DIOSCOREA SPP (Yams)

GBIC/9 DEGRAS, L. and ARNOLIN, A. Station D'Amelioration des Plantes, Petit-Bourg, Guadeloupe. *Breeding in Dioscorea trifida.*

GBIC/10 KAWAKAMI, K. Meijo University, Japan. *Clonal selection in D. oposita and D. Alata.*

GBIC/11 MARTIN, F.W. Federal Experiment Station, Puerto Rico. *A collection of West African yams.*

IPOMOEA BATATAS (Sweet Potato)

GBIC/12 CHARLES, W.B., HOSKIN, D.G. and CAVE, P.J. University of the West Indies, Trinidad, W.I. *Overcoming cross-and-self-incompatibility in Ipomoea batatas (L.) Lam and Ipomoea trichocarpa (Elliot).*

GBIC/13 DEGRAS, L. and ARNOLIN, A. Station d'Amelioration des Plantes, Petit-Bourg, Guadeloupe. *Selective traits in sweet potato.*

GBIC/14 VAN MARREWIJK, G.A.M. Centre for Agricultural Research in Surinam, Paramaibo, Surinam. *The sterility-incompatibility complex in sweet potato Ipomoea batatas (L.) Lam.*

GBIC/15 JONES, A. Agricultural Research Service; Charleston, South Carolina. *A parent-offspring study of root traits in sweet potato.*

GBIC/16 MAGOON, M.L. and KRISHNAN, R. Indian Grassland and Fodder Research Institute, Jhansi, India. *Sweet potato breeding in India - Problems and prospects.*

GBIC/17 THIBODEAUX, S.D., HERNANDEZ, T.P. and HERNANDEZ, T.P. Louisiana State University, U.S.A. *breeding techniques, combining ability of parents, heritabilities, insect resistance and other factors affecting sweet potato breeding.*

GBIC/18 ANTONI, H.J. and FOLQUER, F. Universidad Nacional de Tucuman, Tucuman, Argentina. *Preliminary report on sweet potato (Ipomoea batatas (L.) Lam).*

GBIC/19 HAHN, S.K., HOWLAND, A.K., SINGH, S.R. International Institute of Tropical Agriculture, Ibadan, Nigeria. *Some genetic parameters of sweet potato.*

GBIC/20 HOZYO, Y. National Institute of Agricultural Sciences, Saitama, Japan. *The plant production of wild type plants in Ipomoea trifida (H.N.B.) Don.*

GBIC/21 DOKU, E.V. and LAING, E. University of Ghana, Legan, Ghana. *Flowering characteristics and seed setting of D. rotundata cultivars in Ghana.*

GBIC/22 HRISHI, H. and BAI VIJAYA, K. Central Tuber Crops Research Institute, Trivandrum, India. *Cytology of diploid and triploid Ipomoea obscura (L). Ker-Gawl.*

COLOCASIA & XANTHOSOMA SPP (Edible Aroids)

GBIC/23 CHING K.W. Honolulu, Hawaii, USA. *Taxonomic description of the taro cultivars of American Samoa.*

GBIC/24 KRISHNAN, R. and MAGOON, M.L. Indian Grassland and Fodder Research Institute, Jhansi, India. *Edible aroids - New insights into phylogeny.*

SOLANUM TUBEROSUM (Potato)

GBIC/25 : NJUGUNA, S.K. National Agricultural Laboratories, Nairobi, Kenya. *Potato breeding for resistance to bacterial wilt (Pseudomonas solanaceurum E.F. Smith) in Kenya.*

GBIC/26 : HONESS, B.L. Potato Research Station, Limuru, Kenya. *The raising and selection of new potato (Solanum tuberosum) varieties in Kenya and their bulking to nuclear seed stock levels.*

GBIC/27 : ODSTRCIL, P.L. University of Dar Es Salem, Tanzania, East Africa. *Potato improvement programme for Tanzania potato (Solanum tuberosum) trials.*

PHYSIOLOGY AND BIOCHEMISTRY

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PHYSIOLOGY AND BIOCHEMISTRY

STUDY GROUP REPORT

PB/1 JOLIVET, E., POSTHUMUS, A.C., WAREING, P.F. and WILSON, L.A. Study Group Report, I.S.T.R.C. *The process of tuberisation in tropical root crops.*

TUBERS AND TUBERISATION

PB/2 COKE, L.B. University of the West Indies, Jamaica, W.I. *How tissues of sweet potato (Ipomoea batatas) respond to growth retardants in vitro.*

PB/3 FERGUSON, T.U. University of the West Indies, St. Augustine, W.I. *Tuber development in yams; physiological and agronomic implications.*

PB/4 GETAHUN, A. College of Agriculture, Dire-Dawa, Ethiopia. *Development antomy of tubers of Achote: a potential dryland tuber crop.*

PB/5 INDIRA, P. and KURIAN, T. Central Tuber Crops Research Institute, Trivandrum, India. *A comparative study of anatomical changes associated with tuberization in the roots of cassava and sweet potato.*

PB/6 KUMAR, D., WAREING, P.F. University of Dar Es Salem, Tanzania. *The physiology of tuberization in Solanum andigena.*

PB/7 OKE, O.L. University of Ife, Ile Ife, Nigeria. *Changes in soluble amino acids of some tropical starchy roots during chilling.*

PB/8 OLORUNDA, A.O. and MACKLON, A.E.S. University of Aberdeen, Scotland. *Some physiological investigations of chilling injury in the yam Dioscorea alata L.*

PB/9 VERMA, S.C., SHARMA, T.R., JOSHI, K.C. and SHARDA, R.T. Central Potato Research Institute, Simla, India. *Quality of potato tubers in relation to the stage of development of the plants.*

PB/10 WILSON, L.A. University of the West Indies, St. Augustine, Trinidad. *Components of yield in six sweet potato (Ipomoea batatas L. Lam) cultivars.*

PB/11 WILSON, L.A. University of the West Indies, St. Augustine, Trinidad. *An evaluation of the possible role of some enzyme systems in sweet potato (Ipomoea batatas L. Lam) tuberisation.*

GROWTH, DEVELOPMENT AND YIELD

Root Crops

PB/12 EL-FOULY, M.M. National Research Centre, Cairo-Dokki, Egypt. *Beneficial effects of chlormequat (CCC) on root crops under Egyptian field conditions.*

PB/13 ENYI, B.A.C. University of Papua, New Guinea. *Growth, development and yield of some tropical root crops.*

Manihot esculenta (cassava)

PB/14 COCK, J.H. CIAT, Cali, Colombia. *Some physiological aspects of yield in cassava (Manihot esculenta Crantz).*

PB/15 CUERVO GOMEZ, P.L. Universidad del Valle, Cali, Colombia. *Inter-relationship between the foliar system and root weight in cassava (Manihot esculenta).*

Dioscorea spp (yams)

PB/16 HAHN, S.K., HOWLAND, A.K., SINGH, S.R. International Institute of Tropical Agriculture, Ibadan, Nigeria. *Yield and yield components of yams.*

PB/17 NJOKU, E., OYOLU, E., OKONKWO, S.N.C. and NWOKE, F.I.O. University of Nigeria, Nsukka, Nigeria. *The pattern of growth and development in Dioscorea rotunda.*

PB/18 OKONKWO, S.N.C., NWOKE, F.I.O. and NJOKU, E. University of Nigeria, Nsukka, Nigeria. *The effects of external and internal factors on the development of Node cuttings of Dioscorea bulbifera.*

PB/19 VANDEVENNE, R. Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, Ivory Coast. *Study of yam growth.*

Colocasia & Xanthosoma spp (Edible aroids)

PB/20 KARIKARI, S.K. University of Ghana, Ghana. *The effect of defoliation on the yield of cocoyams (Xanthosoma spp Schott).*

PB/21 MAPES, M.O. and CABLE, W.J. University of Hawaii, Honolulu, Hawaii. *Mericloning of taro varieties, Colocasia esculenta (L) Schott.*

Methodology

PB/22 HRISHI, N., JOS, J.S., NAIR, S.G. and RAJENDRAN, P.G. Central Tuber Crops Research Institute, Trivandrum, India. *Length of petiole as an index for yield in sweet potato.*

PB/23 NATARAJAN, R. and VIJAYAKUMAR, G. Tapioca Research Station, Salem-India. *Studies on the measurement of leaf area in several cassava selections.*

PB/24 REYNOLDS, S.G. College of Tropical Agriculture, Western Samoa. *A note on relationships between leaf area and various leaf parameters for Taro (Colocasia esculenta (L.) Schott.*

PB/25 RAJENDRAN, N., NAIR, P.G. and KUMAR, B.M. Central Tuber Crops Research Institute, Trivandrum, India. *A modified colorimetric method for the estimation of starch in cassava tubers.*

PB/26 SADIK, S. International Institute of Tropical Agriculture, Ibadan, Nigeria. *Screening for acyanogenesis in cassava.*

PB/27 SADIK, S. International Institute of Tropical Agriculture, Ibadan, Nigeria. *Screening sweet potato for low CO_2 compensation point.*

MINERAL NUTRITION

PB/28 CABLE, W.J. University of Hawaii, Honolulu, Hawaii, U.S.A. *Potassium requirement of Taro (Colocasia esculenta (L) Schott cv Niue) in relation to growth, foliar analysis, yield and quality as grown in solution culture.*

PB/29 KAGBO, R.S., DE LA PENA, R.S., PLUCKNETT, D.L. and FOX, R.L. *Mineral nutrition of taro (Colocasia esculenta) with special reference to phosphorus.*

PB/30 LE BUANEC, B. Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, Ivory Coast. *Absorption and removal of the main elements by yams.*

PB/31 OYOLU, C. University of Newcastle Upon Tyne, Newcastle. *Chemical distribution and changes in organs of white Guinea yam (Dioscorea rotundat Poir.) during growth and development.*

BIOLOGY

PB/32 DELANGE, F., VAN DER VELDEN, M. and ERMANS, A.M. Dept. of Radioisotapes and Pediatrics, Brussels University, Belgium. *... thyroid action of cassava in men and in rats.*

PB/33 KARNICK, C.R. Panjab University, Chandigarh, India. *The biology, pharmacognosy and ethnobotany of Dioscorea bulbifera Lin. and some of its varieties from India.*

PB/34 NARTEY, F. University of Copenhagen, Denmark. *Cyanogenesis and metabolic changes associated with ultrastructural development in cassava (Manihot esculenta Crantz).*

BEST AVAILABLE

AGRONOMY, MECHANIZATION AND PRODUCTION SYSTEMS

SESSION 3

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AGRONOMY, MECHANIZATION AND PRODUCTION SYSTEMS

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AMPS/1 : KROCHMAL, A. North Carolina State University, U.S.A. *Propagation studies of cassava.*

AMPS/2 LAL, R. and HAHN S.K. International Institute of Tropical Agriculture, Ibadan, Nigeria. *Effect of method of seed bed preparation, mulching and time of planting on yam (Dioscorea rotundata) in W. Nigeria.*

AMPS/3 NWOKE, F.I.O., OKONKWO, S.N.C. and NJOKU, E. University of Nigeria, Nsukka, Nigeria. *The effects of size of seed yam on growth and development in Dioscorea rotundata.*

AMPS/4 OKIGBO, B.N. University of Nigeria. Nsukka, Nigeria. *Effects of orientation and length of cuttings and polarity on yield and performance of cassava.*

AMPS/5 PLUCKNETT, D.L. and ELUMAH, H.C. University of Hawaii, Honolulu, Hawaii, U.S.A. *The use of nursery transplants in taro. culture.*

AMPS/6 SADIK, S. International Institute of Tropical Agriculture, Ibadan, Nigeria. *New approaches in multiplication of root crops.*

AMPS/7 WHOLEY, D.W. and COOK, J.H. Centro Internacional de Agricultura Tropical, Cali, Colombia. *A rapid method for the propagation of cassava.*

MECHANIZATION

AMPS/8 LEWIS, R.T. National College of Agricultural Engineering, Bedford, England. *Development of a part-mechanical system for harvesting arrowroot in St. Vincent, West Indies.*

AMPS/9 MAKANJUOLA, G.A., ONOCHIE, B.E. and SHULTE, E.E. University of Ife, Ile Ife, Nigeria. *Preliminary studies on the mechanical harvesting of cassava roots in Nigeria.*

AMPS/10 NORMANHA, E.S. Institute of Agronomy, Sao Paulo, Brazil. *Mechanization of the cassava crop.*

AMPS/11 NYSTROM, L.W., SHRUM, J.E. Jr., and DAWSON, R.F. Finca Conception Buena Vista, Guatemala. *A mechanical harvester for Dioscorea composita.*

AMPS/12 ONOCHIE, B.E., and MAKANJUOLA, G.A. University of Ife, Ile Ife, Nigeria. *A study to determine the suitability of present cassava varieties for mechanical harvesting.*

AMPS/13 PLUCKNETT, D.L., HUMPHREY, C. and DE LA PENA, R.S. University of Hawaii, U.S.A. *Taro (Colocasia esculenta mechanization experiments in Hawaii.*

AMPS/14 VANDEVENNE, R. Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, Ivory Coast. *Mechanized yam growing in Ivory Coast.*

EXPERIMENTAL AGRONOMY

Manihot esculenta (cassava)

AMPS/15 GODFREY-SAM-AGGREY, W. University of Sierra Leone, Africa.
(a) *Effects of different fertilizers on root yield, rooting density and average root weight per plant after six years bush fallow in Sierra Leone.*

(b) *Effects of different fertilizers on root yield, rooting density and top/root weight ratio of cassava in two cropping systems in Sierra Leone.*

AMPS/16 GURNAH, A.M. University of Nairoba, Kenya. *The effects of plant population and fertilizers on the yield and components of yield of cassava in the forest zone of Ghana.*

AMPS/17 HOFFMAN, A.S. Centro Regional de Investigaciones Agropecuarias, Peru, S.A. *Comparative yields of eight cultivars of cassava (Manihot esculenta C.) in Tarapoto.*

AMPS/18 MONTALDO, A. Facultad de Agronomia, Venezuela. *Comparative assessment of 65 Venezuelan varieties of cassava.*

AMPS/19 NATARAJAN, R. and RENGASAMY, P. Tapioca Research Station, India. *Preliminary studies on the effect of clipping of leaves on agronomic characters in cassava.*

AMPS/20 OBIGBESAN, G.O. and AGBOOLA, A.A. University of Ibadan, Nigeria. *An evaluation of the yield and quality of some Nigerian cassava varieties as affected by age.*

AMPS/21 ROSANOW, M. H.V.A. International, The Netherlands. *Field experimental check on starch yields of cassava in Indonesia.*

Dioscorea spp (yams)

AMPS/22 GOLLIFER, D.E. Dala Experiment Station, British Soloman Islands. *A cultivar trial with yams Dioscorea alata L. in the British Soloman Islands Protectorate.*

AMPS/23 LYONGA, S.N. I.R.A.T., West Cameroon. *Agronomic studies on edible yams (Dioscorea spp.) in the Grassland Region of the United Republic of Cameroon.*

AMPS/24 UMANAH, E.E. Federal Department of Agricultural Research, Ibadan Nigeria. *Effects of different rates of N.P.K. fertilizers on the yield and storage properties of white yam (Dioscorea rotundata L.).*

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AMPS/25 WANG, H., LI L., CHIEN. C.K. and LIN. C.T.Taiwan Agricultural Research Institute, Taiwan. *Experiments on the sweet potato varieties for canning.*

AMPS/26 WANG, H. Taiwan Agricultural Research Institute, Taiwan. *Sweet potato improvement in Mauritius.*

AMPS/27 SMITH, B.G.C. Dept. of Agriculture, Seychelles. *Vairety trials with sweet potatoes in Seychelles.*

AMPS/28 WARID, W.A. University of Libya, Tripoli, Libya. *Evaluation of sweet potato cultivars in Libya.*

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AMPS/30 EZUMAH, H.C. and PLUCKNETT, D.L. School of Agriculture, Texas, U.S.A. *Response of taro, Colocasia esculenta (L.) Schott, to water management, plot preparation and population.*

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AMPS/32 REYNOLDS, S.G. and NEIRAM, P. South Pacific Regional College of Tropical Agriculture, West Samoa. *The effect of rainfall and time of planting on taro (Colocasia esculenta (L.) Schott yield in Western Samoa.*

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CP/2 BARRIOS, J.H. Universidad Central de Venezuela, Maracay, Venezuela. *Weed control in cassava.*

CP/3 NANGJU, D. I.I.T.A. Ibadan, Nigeria. *Weed control in some important root crops.*

CP/4 RENAUT, G. and MERLIER, H. Institut de Recherches Agronimiques Tropicale et des Cultures Vivrieres, Ivory Coast. *Weed control under mechanised yam growing.*

CP/5 SINGH, K. and PANDITA M.L. Haryana Agricultural University, India. *Herbicidal weed control in tropical carrot for seed production.*

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CP/7 NORMANHA, E.S. PEREIRA, A.S., RIBEIRO DA SILVA, J. and ROSETTO, C.J. Institute of Agronomy, Sao Paulo, Brazil. *New cassava clones resistant to the stem borer.*

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ES/3 JONES, W. Stanford University, Carolina, U.S.A. *Economic prospects for Manioc production.*

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